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Effect of the Milky Way on Magellanic Cloud structure

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abstract A combination of analytic models and n-body simulations implies that the structural evolution of the Large Magellanic Cloud (LMC) is dominated by its dynamical interaction with the Milky Way. Although expected at some level, the scope of the involvement has significant observational consequences. First, LMC disk orbits are torqued out of the disk plane, thickening the disk and populating a spheroid. The torque results from direct forcing by the Milky Way tide and, indirectly, from the drag between the LMC disk and its halo resulting from the induced precession of the LMC disk. The latter is a newly reported mechanism that can affect all satellite interations. However, the overall torque can not isotropize the stellar orbits and their kinematics remains disk-like. Such a kinematic signature is observed for nearly all LMC populations. The extended disk distribution is predicted to increase the microlensing toward the LMC. Second, the disk's binding energy slowly decreases during this process, puffing up and priming the outer regions for subsequent tidal stripping. Because the tidally stripped debris will be spatially extended, the distribution of stripped stars is much more extended than the HI Magellanic Stream. This is consistent with upper limits to stellar densities in the gas stream and suggests a different strategy for detecting the stripped stars. And, finally, the mass loss over several LMC orbits is predicted by n-body simulation and the debris extends to tens of kiloparsecs from the tidal boundary. Although the overall space density of the stripped stars is low, possible existence of such intervening populations have been recently reported and may be detectable using 2MASS.